

1960
Vol. I

PREVENTION OF AIR ACCIDENTS

by

William B. Dickinson, Jr.

	Page
AIR DISASTERS AND THE ACCIDENT RECORD	341
Concern Over Recent Rash of Plane Crashes	341
Accidents in Relation to Air Traffic Volume	342
Effect of Accidents on Traffic and Revenues	343
SAFEGUARDS AGAINST HUMAN FAILURE	345
Raising of Crew Training and Pilot Standards	345
Compulsory Retirement of Pilots at Age of 60	346
Rules on Pilot Practices and Co-Pilot Training	347
Controversy Over Federal Safety Regulations	349
GENERAL ACCIDENT PREVENTION MEASURES	351
Proposed Precautions Against Airliner Sabotage	352
Stress on Airworthiness and Plane Maintenance	353
Steps to Curtail Accidents Due to Bad Weather	354
Improvement of Traffic Control and Landing Aids	356

No. 18
May 11

THE right to reproduce material contained in *Editorial Research Reports* is strictly reserved to the newspaper clients of the service. Verbatim use of such material by others will be permitted only upon written authorization.

RICHARD M. BOECKEL, *Editor*

BUEL W. PATCH, *Associate Editor*

Editorial Research Reports
1156 Nineteenth Street, N.W.
Washington

PREVENTION OF AIR ACCIDENTS

A SERIES of fatal accidents on American scheduled airlines in the last months of 1959 and the first months of 1960 has provoked a searching re-examination of air safety practices by the airlines and by branches of the government concerned with aviation. The Senate Commerce Committee's Aviation subcommittee held hearings last winter to try to find out if there was a dominant pattern of causes for the rash of disasters. The Federal Aviation Agency in turn issued various new regulations intended to raise safety standards on the nation's airlines and to improve an already generally favorable accident record.

Three airliner crashes in the first three months of this year took 147 lives. Thirty-four died when a dynamite blast destroyed a National Airlines plane near Bolivia, N. C., Jan. 6; 50 were killed near Holdcroft, Va., Jan. 18, when a Capital Airlines transport apparently suffered engine failure; and 63 persons perished, March 17, when a Northwest Airlines turbo-prop Electra disintegrated in flames near Tell City, Ind.—possibly torn apart by severe air turbulence. After the second crash, Sen. R. Vance Hartke (D Ind.) suggested grounding of all commercial airliners for exhaustive safety checks. After the Tell City crash, the Civil Aeronautics Board recommended grounding of all Electras for careful inspection. However, the Federal Aviation Agency did not consider such sweeping action necessary in either case.

The accidents early this year followed nine fatal crashes in 1959 that killed 198 passengers and 28 members of airline crews. Scheduled air carriers¹ last year had the high-

¹ Passenger business of non-scheduled airlines has declined sharply in recent years and now amounts to only a small proportion of the total. Non-scheduled lines must observe virtually the same safety regulations as those prescribed for scheduled airlines. Although flying on non-scheduled airlines was at one time considered somewhat hazardous, the 21 members of the Independent Airlines Association recently completed five years without a passenger fatality. F.A.A. Administrator E. R. Quesada said on March 21 that this record had "set an enviable goal for the rest of the industry."

Editorial Research Reports

est fatality rate since 1952 and suffered more fatal accidents than in any year since 1951, when the same number occurred. Fatalities in domestic airline accidents in 1959 numbered 226.

Accidents increased last year also in private flying. The Civil Aeronautics Board reported that private flying accidents totaled around 4,800, and that 778 persons were killed in 432 of the accidents. Private planes had been in 4,584 accidents in 1958, and 717 persons had perished in 384 of the accidents.

ACCIDENTS IN RELATION TO AIR TRAFFIC VOLUME

Commercial air carriers, in spite of recent accidents, have a commendable safety record. Even last year's record was not without encouragement. There were no mid-air collisions involving airliners—a serious problem in 1958²—and the first full year of turbo-jet (pure jet) operations by U.S. airlines was completed without a single fatal accident on a scheduled flight.³ Some of the recent crashes, however, resulted from the kind of known or suspected causes that tend to undermine public confidence in air travel.

The increase in air accidents last year coincided with an increase in air traffic. The number of passengers carried by scheduled airlines rose by more than 18 per cent to a new high of close to 56 million, and the number of passenger-miles flown climbed to 36.3 billion.⁴ A passenger fatality rate in 1959 of 0.68 per 100 million passenger-miles contrasted with a passenger fatality rate of more than 5 per 100 million passenger-miles in 1938. The all-time low for a calendar year was 0.07 passenger fatalities per 100 million passenger-miles in 1954.

Statistics on fatal accidents indicate that travel on scheduled airlines was more than five times as safe as travel by automobile, though only half as safe as travel by bus or railroad, in 1958.⁵ Safety experts have pointed out that the total of 374 persons killed in highway accidents during the three-day 1959-60 New Year's week-end was more than

² See "Safety in the Air," *E.R.R.*, 1958 Vol. II, p. 695. Three private planes were in collision with jet fighter planes last year with loss of four lives.

³ Both of two fatal accidents involving pure jet planes in 1959 occurred on training flights. U.S. airlines operated 75 pure jets in 1959 and expect to add 150 in 1960.

⁴ According to figures compiled by the Civil Aeronautics Board and the Federal Aviation Agency. The total of passenger-miles equals the number of passengers multiplied by the number of miles flown.

⁵ Last year for which complete statistics are available.

Prevention of Air Accidents

half again as large as the total of 226 persons killed in domestic airline crashes during the whole year 1959.

The Air Force made dramatic progress last year in reducing accidents in military flying. Fatalities declined from 705 in 1958 to 376 in 1959. The Military Air Transport Service, sometimes called the world's biggest airline, flew 2.4 billion passenger-miles in scheduled operations in 1959 without a passenger fatality or injury.

General aviation, defined as every type of civil flying except airline operations, was represented by 66,500 planes in 1959—4 per cent more than in 1958. These craft flew 1.5 trillion plane-miles and had a fatal accident rate (not passenger fatality rate) of 3.5 per 100,000 hours flown, compared with 3.3 in 1958. About 10 times as many general aviation plane-miles were flown last year as were flown 20 years ago. During the interval there has been a gradual reduction in accident rates for general aviation, although the rate has changed little during the past four years.

EFFECT OF ACCIDENTS ON TRAFFIC AND REVENUES

Public dependence on time-saving air travel helps to minimize long-range adverse effects of air accidents on the airlines, but the short-term damage may be substantial. Airline bookings in the first quarter of 1960 did not come up to expectations. Company representatives acknowledged that the series of air disasters was partly responsible. They blamed also the worst winter weather since 1947 and a slackening of general business activity.

Repercussions from air accidents were cited by Capital Airlines as contributing to the financial difficulties that forced it to apply for a federal subsidy. The company's application for a \$13 million annual mail subsidy, filed with the Civil Aeronautics Board on March 25, said the Northwest Airlines Electra accident in Indiana, and the Federal Aviation Agency's subsequent imposition of an air speed limit on Electras, had made it impossible for Capital to obtain the financing it needed to carry out planned purchases of new planes.⁶ Referring to the effects of recent air crashes on its business, Capital said:

⁶ Capital has been threatened with foreclosure by Vickers-Armstrongs, Ltd., British aircraft manufacturer which holds a \$33.8 million mortgage on Capital's fleet of Viscount planes. A federal district court hearing in the foreclosure suit is to be held in New York on May 27.

Editorial Research Reports

These accidents, coupled with an unusually large amount of publicity (especially the repeated publicity relative to the unknown causes of these accidents and the speculation that they may have been caused by bombs), have served to shake the confidence of certain segments of the public in the safety of air transportation. . . . Capital's system load factor broke sharply downward following the early-January accident. The adverse publicity arising from that and other accidents and most particularly from the recent Electra accident . . . will undoubtedly continue to depress Capital's load factors for an indefinite period.

Capital Airlines, fifth largest in the nation, suffered a net loss of \$5,415,748 in the first three months of 1960. The Air Transport Association of America has said that although domestic trunk airlines established all-time traffic and revenue records in 1959, the industry's net profit margin after taxes was only 2.9 per cent. The 12 domestic carriers lost around \$9 million in the first two months of this year.

Some aviation experts think the most damaging effect of any large number of airline accidents is its tendency to inhibit the normal growth of air transportation. A survey of domestic air travelers, carried out for American Airlines last year by the Opinion Research Corporation, showed that travel by air was still far from common practice. It was found that only 7 per cent of all trips of 200 miles or more in a year's time were made by commercial airliner;⁷ only 22 per cent of the country's inhabitants had ever traveled on a domestic airline; 15 per cent of the air travelers accounted for 64 per cent of all journeys by air. It was estimated that 88 per cent of the air trips made in 1960 would be by persons who had flown before.

⁷ The majority of such trips were made by passenger automobile.

Safeguards Against Human Failure

HUMAN ERROR has been the largest single factor in responsibility for commercial air accidents. The Federal Aviation Agency estimates that nearly 50 per cent of 136 air carrier accidents⁸ in 1959 could be attributed to some error or failure on the part of the flight crew, 25 per cent to faulty maintenance of the aircraft by ground personnel, 18 per cent to failure during operation of some part of the plane, and the remainder to encounters with severe air turbulence. The factor of personal error has been found in about the same proportions in air carrier accidents, fatal and non-fatal, for at least half a dozen years. F.A.A. Administrator E. R. Quesada told the Senate Aviation subcommittee on Jan. 12:

In our initial appraisal of aviation safety, we found that there was a disturbing indifference or laxness in two distinct areas. These were pilot and cockpit discipline, and aircraft maintenance. Accordingly, the emphasis of our efforts has been toward correcting these deficiencies as rapidly as possible.

F.A.A. during 1959, its first year of operation, issued several regulations designed to reduce the chances of human error. Air carriers were required to get F.A.A. approval of flight crew training programs. Qualification requirements for co-pilots were raised to correspond more closely with the requirements for pilots-in-command. Higher medical standards for pilots were imposed. An upper-age limit of 59 years was set for pilots of air carrier transports. Skill and experience standards for private pilots also were raised. To guard against passenger conduct prejudicial to in-flight safety, a limitation on consumption of alcoholic beverages on airliners was applied; the new rule, effective March 10, apparently doomed efforts in Congress to put a total ban on drinking aloft.

Quesada has conceded that F.A.A.'s new or revised regulations "obviously had little impact on safety in 1959," but he asserted in his testimony on Jan. 12 that they hold "a very definite promise for the future." He agreed that "We must develop and maintain the wisdom, foresight and decisiveness, and the moral courage necessary to eliminate hazards before they result in tragic loss of life, and human

⁸ Including accidents in non-revenue as well as revenue operations.

Editorial Research Reports

misery." C.A.B. Chairman James R. Durfee had told the subcommittee the previous day that "If there is a special problem disclosed by the 1959 record it is simply this—that renewed and increased attention must be given to the fundamentals of safety: to careful training, careful maintenance, and careful operations in general."

COMPULSORY RETIREMENT OF PILOTS AT AGE OF 60

Establishment of 59 years as the maximum age for airline pilots was ordered by the F.A.A. under its powers to prescribe such regulations affecting air carriers as "will best tend to reduce or eliminate the possibility of, or recurrence of, accidents." The order became effective March 15 over the protests of the Air Line Pilots Association, representing 30,500 airline pilots, but with the support of the Air Transport Association, representing the carriers.

The federal agency acknowledged that it could not be demonstrated that age had been a factor in any particular air carrier accident. But it said: "Because of the progressive deterioration of both physiological and psychological functions which normally occur with age, allowing pilots in this age group to remain in command of aircraft . . . would be a hazard to safety in air carrier operations. These deteriorations result in significant medical defects."

The new regulations state that "No individual who [has] reached his 60th birthday shall be utilized or serve as a pilot on any aircraft while engaged in air carrier operations." An age minimum of 23 years to qualify for a Class I (commercial) pilot's license was left unchanged. Retirement of around 40 pilots aged 60 or over was made necessary by the new rule. It was estimated that 250 air carrier pilots would reach age 60 by 1967. Eight years ago none had reached that age—a circumstance reflecting the age of the airline industry itself.

F.A.A. found additional justification for the mandatory retirement rule in a showing that pilots aged 55 or over took twice as long as pilots under 40 to qualify to fly Boeing 707 jet planes. "This is logical," the agency pointed out, "since aging is directly related to the loss of ability to perform highly skilled tasks rapidly, to resist fatigue, to maintain physical stamina, to perform effectively in a complex and stressful environment, to apply experience, judgment and reasoning rapidly in new, changing and

Prevention of Air Accidents

emergency situations, and to learn new techniques, skills and procedures."

Clarence N. Sayen, president of the Air Line Pilots Association, called the retirement-at-60 rule "whimsical and capricious" and contended that there was "no shred of evidence to justify such a rule." Sayen said C.A.B. records disclosed only two fatal airline accidents since 1946 that had involved captain-pilots 50 years of age or older. Efforts of A.L.P.A. to obtain an injunction against enforcement of the rule were unavailing in three federal courts. Judge Alexander Bicks in federal district court in New York, denying an injunction on March 14, said: "Any attempt to weigh the countervailing consideration of dollar loss [to pilots] against the public safety in air carrier operations borders on vulgarity."⁹

Foreign air carriers have established compulsory retirement ages of 60 or under and have fixed separate age limits for transfer to jets. An F.A.A. proposal to limit command of jet airliners to pilots rated for flying such aircraft prior to their 55th birthday now is under consideration by the agency. F.A.A. proposed the age of 55 "on the basis that it marks the point at which the detrimental effects of age on physiological and psychological functions have become significant."

Introduction of jet planes has been cited by the federal agency as adding to the urgency of establishing maximum age limits. Senior pilots have had first choice of the new aircraft; as a result, the average age of jet pilots now is higher than the average age of airline pilots in general. Jets are more difficult to fly, travel at higher speeds and higher altitudes, and carry more passengers than other airliners. Quesada has said of the civil jet transport: "While a wonderful aircraft, it is very unforgiving of mistakes or failures on the part of its crew."¹⁰

RULES ON PILOT PRACTICES AND CO-PILOT TRAINING

A Boeing 707 jet transport's close brush with disaster over the North Atlantic on Feb. 3, 1959, had wide reper-

⁹The U.S. Court of Appeals on April 21 unanimously affirmed the lower court's denial of an injunction. Noting that Quesada was "an expert in his field," the appeals court said it was "not the business of courts to substitute their untutored judgment for the expert knowledge of those who are given authority to implement the general directives of Congress."

¹⁰Air Force and Army officers are allowed to fly until they retire, provided they can pass the physical examinations; the Navy, on the other hand, allows no officer over age 45 to fly except in the company of a pilot below that age. The oldest pilot in the Military Air Transport Service is 88.

Editorial Research Reports

cussions in the aviation world and strengthened F.A.A.'s case for stricter air carrier regulations. The Pan American World Airways plane, with 119 passengers aboard, was cruising in darkness at 35,000 feet when the automatic pilot disengaged. The craft began a gradual descent, but it soon picked up speed, rolled on its back, and went into a vertical dive. When the plane was pulled out of the dive at 6,000 feet, it was subjected to gravitational forces that exceeded its design limits by a wide margin.

The warning light, indicating the automatic pilot's disengagement, had gone unnoticed because the captain was in the passenger cabin for reasons termed later by F.A.A. as "not necessary to his normal duties," and the co-pilot was engrossed in computations and failed to see what had happened until the plane was in a steep spiral. F.A.A. assessed a \$1,000 penalty against the pilot-in-command, a \$1,000 penalty against the company (for failing to install tape in the flight recorder), and a 90-day suspension of the co-pilot's certificate.

In a report on the incident, Nov. 3, 1959, the Civil Aeronautics Board said: "The Board does not condone extended absences from the cockpit by crew members but recognizes that absences of short duration are sometimes necessary. The Board believes that during the absence of either pilot from the cockpit, the remaining pilot should devote his entire attention to flying the aircraft." F.A.A. addressed letters to all airline presidents asking them to stop "forthwith" the practice by some pilots of leaving the cockpit to engage passengers in conversation during flight.

Pan American's near-accident directed attention to the competence of co-pilots. Quesada told a House Appropriations subcommittee on Feb. 3 that he had been shocked to find, when he took office, that "a person could be a co-pilot on a 707, and as far as the rules are concerned, he could have gotten his commercial license and instrument rating in a Taylor cub, and the only requirement was that he make three landings and three takeoffs."

F.A.A. sought to remedy the situation by issuing a rule requiring the second in command of an air transport to have virtually the same training, though not necessarily the same aircraft rating or hours of experience, as the top pilot. Airlines were given until Jan. 1, 1961, to set up co-pilot training programs meeting F.A.A. specifications. The

Prevention of Air Accidents

Air Line Pilots Association thinks that the new regulation does not go far enough. It wants the co-pilot to have the same aircraft rating as the captain and to take a proficiency check every six months instead of only once a year.

Reliance on individual airlines to train their own flight personnel is regarded by F.A.A. as not wholly satisfactory. Not only is the training the responsibility of the individual carrier; around four-fifths of the qualifying tests for new pilots are conducted by designated company pilots. F.A.A. inspectors test all pilots for ratings to fly turbo-jet airliners.

After certification, captains in command of airliners must pass a flight proficiency examination given by the airline, and a medical examination given by an F.A.A.-designated physician, every six months. The mental condition of pilots is evaluated only in a general way during the physical examination. F.A.A. has proposed that the airlines provide special counseling services for pilots with pressing personal problems.

A regulation requiring medical examinations of non-airline pilots to be given only by medical examiners designated by the Civil Air Surgeon of the Federal Aviation Agency is to go into force June 15. The rule was strongly opposed by the Aircraft Owners and Pilots Association, but it had American Medical Association support. Private pilots have been allowed in the past to go to any doctor for an examination, and many airmen who did not meet F.A.A. standards were nevertheless passed by examining physicians. F.A.A. considered the change of procedure necessary to "maintain a group of medical examiners who are clearly responsive to the needs of public safety in the performance of examinations." Private pilots have to be re-examined every two years.

CONTROVERSY OVER FEDERAL SAFETY REGULATIONS

Tightening of controls on commercial and private aviation in F.A.A.'s first year of operation led to accusations that flight crews were being subjected to petty harassment by unqualified or incompetent federal inspectors. Leading critics of the new federal agency's rule-making were the Air Line Pilots Association and the Aircraft Owners and Pilots Association. A newspaper correspondent who sought an explanation for the controversy wrote:

Editorial Research Reports

The problems of safety, according to informed operations personnel in the industry, have their roots in the hands-off attitude of previous administrators who wanted to enjoy the easy fraternization of the industry. It is said on Capitol Hill that safety was seldom mentioned except in passing and that when Congress was looking for ways to cut the budget, the slashes could be made in funds for the aviation agencies because the administrators failed to stand up and fight.

Now, the industry, psychologically conditioned to different ways, faces a strong administrator who has lashed out at "certain industry groups" seeking to pressure his agency for their own special interests. He has indicated his policy will be tougher in the future and that he will not tolerate the laxness, complacency and defiance he has found in pilot discipline and aircraft maintenance.¹¹

F.A.A. Administrator Quesada, noting that more than 40 organizations were engaged in lobbying on behalf of the aviation community, told the Senate Aviation subcommittee on Jan. 12 that "No special interest group can be permitted to hold the pen that writes the rules." When asked in a copyrighted magazine interview why pilots and some other groups were critical of the tightened rules and stricter enforcement, Quesada replied: "They have been critical, primarily, because we have seen fit to apply, with fairness and justice, the rules that have been written for some 20 years."¹²

A.L.P.A. President Sayen has accused agency inspectors of carrying out "a childish Gestapo program" by filing violation reports against airliner captains who were absent from the flight deck for as brief a period as seven minutes. He suggested to the Senate Aviation subcommittee on Jan. 19 that F.A.A. did not comprehend factors vital to maximum safety in air travel. He said:

In summary of the rule-making record in 1959, we must conclude that, excluding the rule on airborne radar and the possibility of some help from the requirement that training programs be approved by the F.A.A., the agency in its rule-making seems not to have diagnosed the needs of the industry during its first year of operation. Rather than coming to grips with the basic immediate needs of air safety, the emphasis seems to be on long-term research programs which hopefully will produce some result in the indeterminate future and an enforcement program which hopefully, in some way, will compensate for some of the inadequacies without removing the basic problem.

¹¹ William M. Blair, "Air Safety Problem Again Under Scrutiny," *New York Times*, Jan. 24, 1960, IV, 4.

¹² "Why This Latest Rash of Air Disasters?" *U.S. News & World Report*, Feb. 1, 1960, p. 50.

Prevention of Air Accidents

The pilots' union president indicated that the best way to promote air safety was to lengthen airport runways, improve approach lighting and other facilities, and control the use of airspace more effectively.

General Accident Prevention Measures

STRONG SUSPICION that one, if not both, of two recent airline crashes resulted from sabotage has raised puzzling questions. Sabotage figured in only two accidents in the quarter-century of U.S. scheduled airline operations before 1959. Forty-four persons were killed in the crash of a United Air Lines DC-6B over Colorado on Nov. 1, 1955. John Gilbert Graham was convicted of having planted a home-made time bomb aboard the plane to collect \$37,500 in insurance on his mother's life; he was executed for murder. In the other case, in 1957, a passenger locked himself in the lavatory of an airliner over California and touched off a stick of dynamite strapped to his body. The man was killed, but the plane landed without injury to other passengers.

The problem of sabotage was raised again when a National Airlines plane plunged into the Gulf of Mexico last Nov. 16 and when another National plane fell near Bolivia, N. C., on Jan. 6; all 42 persons aboard died in the Gulf crash and all 34 in the Bolivia crash. A mysterious element was injected into the Gulf accident when it was discovered weeks later that Robert Vernon Spears, a heavily insured naturopath who was thought to have gone down with the plane, had given his ticket to another man. In the Bolivia crash, C.A.B. investigators found evidence of a dynamite blast near the seat occupied by Julian A. Frank, a New York City attorney who had recently taken out nearly \$1 million of life insurance and who was reported to have been Spears' lawyer. Final determination of the causes of the two accidents has not yet been made.

Quesada observed at last winter's hearings in Washington: "To be candid, I must say dealing with possible danger from the criminal passenger is the most baffling of all [safety] problems. We can look into a passenger's baggage but we cannot look into his mind."

Editorial Research Reports

PROPOSED PRECAUTIONS AGAINST AIRLINER SABOTAGE

Numerous proposals for guarding against sabotage on airliners have been made in Congress and in the aviation industry. It has been suggested, for example, that all payments under insurance policies on the life of a person who commits suicide by sabotaging an airliner be outlawed.¹³ The Senate Aviation subcommittee considered bills to require airline passengers to agree to inspection of baggage on request. At present, a passenger is entitled to refuse such a request unless a warrant has been issued. Another proposal is to authorize the airlines to announce that baggage will be spot-checked. F.A.A. informed the subcommittee, Feb. 23, that it was not yet ready to make recommendations on the question.

J. Edgar Hoover, Director of the Federal Bureau of Investigation, suggested on Jan. 22 that F.A.A. consider requiring the baggage of airline passengers to be X-rayed. Most of the air carriers were reported to oppose this plan on the ground that inspections would show up harmless metal objects like safety razors and would delay loading of planes.

Aviation officials generally were of opinion that little or nothing could be done to prevent deranged persons from taking bombs aboard planes.¹⁴ They hoped that attempts at sabotage might be deterred by growing realization that crime in the air was not likely to go undetected. "Investigations into aviation accidents are probably the most thorough, the most complete ever made of any disaster or mishap," F.A.A. Administrator Quesada said on Jan. 22.

Legislation enacted in 1956 makes any person who willfully damages an air transport or commercial motor vehicle engaged in interstate commerce subject to a fine of \$10,000 or imprisonment for 20 years or both. If death results, the person responsible becomes liable to life imprisonment or the death penalty. The law prescribes also a fine of \$1,000 or one year in prison or both for conveying false information about any attempt to perform such an act. The F.B.I. has made 11 arrests in the past month under an in-

¹³ Beneficiaries of most insurance policies held by persons who commit suicide cannot collect now unless the policy was in effect for two years prior to self-inflicted death.

¹⁴ The difficulties involved were demonstrated on April 28 when a passenger on a Venezuelan airliner suddenly went berserk, pulled a hand grenade from his pocket, and hurled it. The grenade exploded and 10 of the 13 persons on the plane were killed in the ensuing crash.

Prevention of Air Accidents

tensified drive against persons falsely reporting the presence of bombs on airliners.

STRESS ON AIRWORTHINESS AND PLANE MAINTENANCE

Proposals to require installation of automatic flight recorders on commercial airliners have been given impetus not only by the recent crashes in which sabotage was suspected but also by the unexplained explosion of two Lockheed Electra turbo-prop airliners. Inquiries into the Electra disasters were hampered by lack of data that would probably have been preserved if the planes had been equipped with flight recorders. The recorders, built to withstand fire and the impact of a crash, automatically record on a steel or aluminum tape the plane's air speed, altitude, vertical acceleration (gravity forces), and direction as well as the time. Air safety experts believe, moreover, that recorders could be so improved as to report almost any desired data—wing or propeller malfunctions, fuel flow, airframe stress, even explosions. Recorders are now mandatory only on pure jet planes, but F.A.A. has initiated action to require that all turbine-powered airliners, including turbo-props, be equipped with flight recorders by Sept. 1, 1960.

Disintegration of the Electra turbo-prop airliner near Tell City, Ind., last March and disintegration of another Electra over Buffalo, Texas, last September raised serious doubts about the airworthiness of this type of aircraft. Both planes lost a wing in flight. After the Tell City disaster, F.A.A. ordered the six lines operating the giant jet-powered craft to reduce normal operating speeds from 400 miles an hour to 258 miles an hour to give the planes a greater margin of safety when exposed to buffeting. The lines were ordered also to conduct rigid inspections and tests for any sign of metal fatigue or structural damage. F.A.A. announced, April 25, that the special inspections had disclosed "no significant new findings" to alter its earlier decision against grounding of the Electra fleet.

Emphasis on airworthiness requirements has been increased by introduction of the jet plane, which the F.A.A., according to Quesada, has found "more complex and even less forgiving of the slightest error in its manufacture, in its maintenance, in preflight planning and in its airborne operation, than originally anticipated." It takes an F.A.A. inspector 12 hours to run a detailed inspection of the

Editorial Research Reports

control system of a modern jet, whereas only three hours are needed to inspect a modern propeller-driven plane.

The agency on Jan. 8 ordered its flight inspectors to monitor speed-control practices on jet airliners closely to make sure that pilots were not flying the aircraft faster than it is safe to do. Information gathered from flight recorders had shown that speed limits were being exceeded "in a large percentage of flights with a frequency which is alarming because of the hazardous implications involved in exceeding design loads."

F.A.A. is revising a part of the regulations governing issuance of mechanic certificates in an effort to bring the requirements into line with the special needs imposed by the increased complexity of aircraft. The agency also is closely monitoring the maintenance programs of individual air carriers. After F.A.A. had looked at the program of one airline, it made the line's continued operation dependent on extensive changes in its maintenance practices.

STEPS TO CURTAIL ACCIDENTS DUE TO BAD WEATHER

Statistics indicate that bad weather has been responsible for an increasing proportion of plane crashes. Weather was the major cause of 6 per cent of all aircraft accidents in 1930, of 8 per cent in 1937, and of 10 per cent in 1947. According to a C.A.B. study, weather was a causal factor, though not necessarily the major factor, in 26 per cent of 815 accidents suffered by planes of scheduled airlines in the period 1948-57. Improvement of aircraft performance capabilities and of airport landing aids no doubt has led to more flying under weather conditions which in the past would have grounded most planes. A great increase in private flying also has affected the situation. C.A.B. Chairman Durfee pointed out to the Senate Aviation subcommittee on Jan. 11 that:

It is apparent that the most important single factor in general aviation accidents involved flight into adverse weather conditions with which the pilot was unable to cope. Approximately 40 per cent of the total number of fatalities in general aviation can be attributed to this factor.

To stem the trend, F.A.A. in 1959 ruled that all newly certificated private and commercial pilots must demonstrate a familiarity with navigation and flight instruments used under low visibility conditions. Another new rule

Prevention of Air Accidents

requires almost all air transports to carry airborne weather radar. These devices warn pilots of areas of extreme turbulence, enabling the pilots to steer around them or to thread through areas of the worst turbulence. All jet-powered aircraft must be so equipped by July 1; the largest conventional engine airliners must install radars by Jan. 1, 1961, and most other transports within the following year. Quesada believes that installation of radars will "go a long way toward reducing accidents caused by encountering severe turbulence associated with thunderstorms or precipitation." The Air Line Pilots Association calls airborne radar "one of the most important contributions to air safety in recent years."

The decision to require airborne radar on air carrier craft came after a Capital Airlines Viscount turbo-prop had disintegrated in the air during a thunderstorm north of Baltimore, Md., May 12, 1959, killing 27 passengers and a crew of four. The plane was equipped with radar, but the set was out of order. Evidence indicated that the plane had entered an area of severe turbulence while its crew was trying to dodge storm clouds visually.

The Tell City disaster last March revealed a new problem—invisible clear-weather turbulence at the high altitudes where jet planes fly. Weather specialists are aware that clear-air turbulence, which cannot be detected by radar at its present stage of development, is related to the position of the jet stream—a swift river of air at altitudes of 25,000 to 40,000 feet. Under certain conditions the jet stream sets up "wind shears," where wind speeds vary markedly at different altitudes, and a plane flying from one "blade" of the "shears" to another takes a terrific pounding. F. W. Reichelderfer, Chief of the U.S. Weather Bureau, announced on March 28 that the bureau was making increased efforts to penetrate the mysteries of upper air currents. He said that weather men do not yet have enough data to pinpoint the specific location of clear-air turbulence.

Aviation groups long have sought better weather forecasting services. Special high-altitude forecast centers were established by the Weather Bureau in 1959 to meet the needs of jet transports. In addition, semi-automatic, closed-circuit television weather briefing systems were installed at New York and Miami late last year, and addi-

Editorial Research Reports

tional installations are planned at San Juan, Puerto Rico, and Chicago and San Francisco this year.

The Weather Bureau is planning to participate with F.A.A. and the Air Force in a long-term research program, intended to modernize and largely automate weather observing and forecasting for purposes of aviation. Progress is being made toward full operation of 88 low-frequency radio weather information channels. The 11 channels now in operation provide continuous taped weather broadcasts for general aviation. A large part of the general aviation traffic operates from airports not connected with weather teletypewriter circuits. Ground radar weather reports, now made from more than 75 locations distributed across the country, have greatly improved the "weather watch" capabilities of the Weather Bureau.

IMPROVEMENT OF TRAFFIC CONTROL AND LANDING AIDS

The nation's airspace problem, already acute, promises to become more so as additional high-speed jets go into service and civil aviation expands. Aviation officials fear that the problem of separating aircraft and monitoring flights is far from solved.

The first mid-air collision in two years involving a commercial airliner occurred on April 20 when a Piedmont Airlines plane with 40 persons aboard collided with a business plane while approaching the Hickory, N. C., airport. Four persons on the private craft were killed, but the airliner landed without injury to passengers or crew. The Air Line Pilots Association has said on the subject of near-misses in flight that it has "no reason to believe that the number of these has been reduced from previous years." It contends that F.A.A. discouraged reporting of near-misses by discontinuing the immunity from penalty which had been extended to pilots reporting such incidents.

Federal outlays to improve air traffic control were increased from \$16 million in the fiscal year 1956 to \$75 million in fiscal 1957, following a collision of two airliners with loss of 128 lives over the Grand Canyon on June 30, 1956. Expenditures in fiscal 1959 amounted to \$146 million and are expected to total \$175 million in the fiscal year ending next June 30. A spending program aggregating around \$1 billion is projected for the next five years. Existing traffic control systems, in the opinion of airline pilots,

Prevention of Air Accidents

fall far short of what is needed. Sayen told the Senate Aviation subcommittee on Jan. 18:

Our system of air traffic control is essentially the same as it has been during recent years, although its capacity has been increased somewhat. Insofar as the pilot is concerned, he is still not provided with the positive [controlled] separation he feels is required in many areas. . . . The main dependence is still on the "see and be seen" philosophy, which practically everyone agrees has not afforded positive separation for many years.

Positive air traffic control between altitudes of 17,000 and 22,000 feet, in good as well as bad weather, was initiated last September on three airways linking New York and Washington with Los Angeles and San Francisco and on two airways between Washington and Chicago. All flying along these airways must be conducted under an instrument flight rules plan, with an air traffic control clearance, and under positive control of a ground station during the entire flight, regardless of weather conditions.

All jet flights at altitudes above 24,000 feet now are being monitored by F.A.A. with the aid of the early warning radar network of 38 military stations. These stations supplement F.A.A.'s own long-range radars. The combined radar systems enable F.A.A. to track all jet flights from takeoff to touchdown except in a small section of the Rocky Mountain region. The agency plans to alleviate air traffic jams by installing, beginning in 1963, high-speed data computers and other electronic devices to report the position of airplanes, their estimated time of arrival at airports, and other pertinent information.

Extensive research has been devoted to developing an in-flight collision prevention device to warn the pilot of a plane that is on a collision course with another aircraft. Quesada has said that hopes of developing such a system are "very, very dim," but research is continuing. He reported last winter that F.A.A. was developing three-dimensional radar which eventually would enable air traffic controllers to spot the position, bearing and altitude of aircraft within a 50-mile radius of an airport. The Army on April 14 said it had designed a low-cost radio apparatus that held promise of eliminating 99 per cent of all air collisions, but the concept now exists only on paper.

Many air safety experts consider inadequate airport facilities the weakest link in prevention of air accidents. C. C.

Editorial Research Reports

Spencer, Jr., a regional vice president of the Air Line Pilots Association, said in a recent magazine article:

Our statistics show there is a definite pattern connected with these recent accidents, and with accidents over the years. Statistics show a pattern of accidents on the landing approach—on the approach to the airport or on the airport itself. Of 39 accidents [fatal and non-fatal] during 1959, for instance, 14—or almost 36 per cent—occurred during the approach or landing. Most of them can be attributed to lack of adequate approach or landing facilities.¹⁵

Spencer's view was supported by Sen. A. S. Mike Monroney (D Okla.), chairman of the Senate Aviation subcommittee. The senator has called modern approach and runway lighting "the extra margin that forgives error or bad piloting or failure to observe the proper flight procedure." He pointed out at the subcommittee hearing on Jan. 13 that only three airports in the United States—Newark, Idlewild and Atlanta—have modern high-intensity light approach systems on both ends of their major instrument runways.

The crash of an American Airlines Electra coming in to land on the "dark side" of New York's La Guardia airport, Feb. 3, 1959, brought the issue of proper airport lighting to public attention. Although the plunge into the East River, which took 50 lives, was attributed to a number of factors including a faulty altimeter, bad weather, and pilot inexperience on the type of plane involved, some experts thought the accident could have been avoided if the airport approach had been better lighted. F.A.A. has reported that tests to serve as a basis for developing a standard airport lighting system for national, and possibly international, use will soon be completed.

Lack of control towers at many airports has been cited as a conspicuous deficiency affecting air safety. Fewer than one-half of the 563 airports used by scheduled airlines in the 50 states have control towers to direct traffic movement. Furthermore, too few airports have all-weather landing systems, and the systems in use are not considered entirely satisfactory. The airlines last year forfeited \$23 million of revenue by reason of inability to deliver passengers and cargo at destination airports.

¹⁵ "Can We Stop Air Accidents?" *New York Times Magazine*, Feb. 7, 1960, p. 20. Four of the nine fatal air carrier accidents in 1959 took place during landing approaches. F.A.A. control towers handled nearly 27 million landings and takeoffs last year.

